

REMARKS/ARGUMENTS

The amendments and remarks hereto attend to all outstanding issues in the pending office action of 25 October 2006. Claims 1-20 are pending in this application before the amendments herein. Claims 1-3, 7-9, 13, 17 and 20 are amended herewith. Claims 21-26 are new.

In the Claims

Claim 1 is amended to clarify that the filament-cathode and the mirror electrode are within walls of a chamber and are opposed to each other along a first direction without intervening structure, that the method includes applying a first potential to a positive end of the filament-cathode and a second potential to the walls of the chamber, both potentials relative to a potential at a negative end of the filament-cathode, that the mirror electrode potential is controlled between the potential at the negative end of the filament-cathode and the second potential, and that the ion beam is emitted from the chamber in a second direction that is generally perpendicular to the first direction. This amendment is supported in the specification as filed at page 7, line 14 - page 9, line 3, and by FIG. 2 and FIG. 4.

Claim 2 is amended to clarify that reducing an ion beam intensity is part of a step of controlling potential of a mirror electrode, as defined in claim 1, and to utilize the term "second potential" as defined in claim 1. Claim 3 is amended to replace the clause "relative to the filament-cathode" with "toward the potential at the negative end of the filament-cathode" in accordance with the potential defined in claim 1.

Claim 7 is amended to clarify that the filament-cathode and the mirror electrode are within walls of a chamber and are opposed to each other along a first direction, that the ion source includes a grid electrode having an O-shaped grid portion located between the filament-cathode and the mirror electrode along the first direction, that the method includes applying a potential to the filament-cathode relative to a potential at a negative end of the filament-cathode, connecting the mirror electrode to the potential at the negative end of the filament-cathode, controlling the potential of the grid electrode

positive or negative relative to the filament-cathode to control the number of electrons available for ionization between the grid electrode and the mirror electrode, and emitting the ion beam from the chamber in a second direction that is generally perpendicular to the first direction. This amendment is supported in the specification as filed at page 8, line 19 - page 9, line 3 and at page 9, line 15 - page 11, line 1, and by FIG. 3 and FIG. 4.

Claim 8 is amended to clarify that reducing an ion beam intensity is included in a step of controlling potential of the grid electrode, as defined in claim 7, by driving the potential of the grid electrode negative relative to the filament-cathode. The amendment to claim 8 is supported in the specification as filed at page 10, lines 13-16 and by FIG. 4. Claim 9 is amended to clarify that increasing an ion beam intensity is included in a step of controlling potential of the grid electrode, as defined in claim 7, by driving the potential of the grid electrode to or near the potential of the filament-cathode. The amendment to claim 9 is supported in the specification as filed at page 10, lines 16-18 and by FIG. 4.

Claim 13 is amended to clarify that an ion source apparatus includes an ion chamber having mutually opposed walls that are fixed at a wall potential, that one of the walls forms an aperture for emitting an ion beam in a first direction, that the filament-cathode is located on one side of the ion chamber and is fixed at a filament-cathode potential, that the mirror electrode is located on the other side of the ion chamber in a second direction relative to the filament-cathode, the second direction being approximately perpendicular to the first direction, and that the mirror electrode is connected to a circuit to vary its potential relative to the wall potential and the filament-cathode potential so as to vary the number of the electrons available in the ion chamber for ionization. This amendment is supported in the specification as filed at page 7, line 14 - page 9, line 3, and by FIG. 2 and FIG. 4.

Claim 17 is amended to clarify that an ion source apparatus includes an ion chamber having mutually opposed walls that are fixed at a wall potential, one of the walls forming an aperture for emitting the ion beam in a first direction, the chamber configured to receive an ion precursor gas, that the filament-cathode is located on one side of the ion chamber and is fixed at a filament potential, that the mirror electrode is

located on the other side of said ion chamber in a second direction relative to the filament-cathode, the second direction being approximately perpendicular to the first direction, and that at least one grid electrode extends inside the ion chamber and is positioned between said filament-cathode and said mirror electrode along the second direction, and is connected to a circuit operable to vary a potential of the grid electrode positive or negative relative to the filament-cathode so as to vary the number of electrons available in the ion chamber for ionization. This amendment is supported in the specification as filed at page 8, line 19 - page 9, line 3 and at page 9, line 15 - page 11, line 1, and by FIG. 3 and FIG. 4. Claim 20 is amended for antecedent correspondence with its base claim 17.

New claim 21 is supported in the specification as filed at page 10, lines 1-3 and by FIG. 3. Claim 21 is believed patentable over the art of record because it depends from claim 17, argued below as patentable, and additionally because the art of record does not disclose an O-shaped grid electrode.

New claim 22 is supported in the specification as filed at page 7, line 11 through page 8, line 18 and by FIG. 2. Claim 22 is believed patentable over the art of record because the art of record does not disclose, in a Bernas-type ion source having a filament-cathode and a mirror electrode disposed along a first direction within a chamber, the ion source being operable to generate an ion beam from the ionization of an ion precursor gas in the chamber by electrons emitted from the filament-cathode, the chamber having walls, one wall forming an aperture to allow emission of the ion beam from the chamber in a second direction that is generally perpendicular to the first direction, a mirror electrode programming circuit for controlling a potential of the mirror electrode between a potential of the filament-cathode and a potential of the walls.

New claim 23 is supported in the specification as filed at page 7, line 11 through page 8, line 18 and page 9, line 15 through page 11, line 1, and by FIG. 3. Claim 23 is believed patentable over the art of record because the art of record does not disclose, in a Bernas-type ion source having a filament-cathode and a mirror electrode disposed along a first direction within a chamber, the ion source being operable to generate an ion beam from the ionization of an ion precursor gas in the chamber by electrons emitted from the

filament-cathode, the chamber having walls, one wall forming an aperture to allow emission of the ion beam from the chamber in a second direction that is generally perpendicular to the first direction, at least one grid electrode located between said filament-cathode and said mirror electrode along the second direction and a grid programming circuit for controlling a potential of the grid electrode positive or negative relative to a potential of the filament-cathode.

New claim 24 is supported in the specification as filed at page 10, lines 1-3 and by FIG. 3. Claim 24 is believed patentable over the art of record because it depends from claim 23, argued above as patentable, and additionally because the art of record does not disclose a grid electrode including an O-shaped grid portion.

New claim 25 is supported in the specification as filed at page 10, lines 4-6 and by FIG. 3. Claim 25 is believed patentable over the art of record because it depends from claim 23, argued above as patentable, and additionally because the art of record does not disclose a grid electrode located in relative proximity to the filament-cathode.

New claim 26 is supported in the specification as filed at page 10, lines 4-6 and by FIG. 3. Claim 26 is believed patentable over the art of record because it depends from claim 23, argued above as patentable, and additionally because the art of record does not disclose a grid electrode, as defined in claim 23, that includes a plurality of grids.

No new matter is added to the application through any of the claim amendments.

Response to Office Action

The following paragraphs follow the order of the paragraphs in the Office Action mailed 25 October 2006 in this application.

1 - 10. Response to Arguments

Applicant has reviewed and disagrees with the Examiner's remarks in this section relative to U.S. Patent 4,684,848 to Kaufman ("Kaufman") for a "Broad-beam Electron Source" (Kaufman, Title). It is noted for the sake of discussion below that the Examiner alleges, in paragraph 1, that a "decelerator grid 106" shown in Kaufman is a "mirror electrode," even though Kaufman fails to use such language or describe it in the same

terms as in Applicant's specification. It is also noted that the Examiner argues, in paragraph 9, that "the grids at least extend across a width of the chamber opposite the filament, and also at least define an outer boundary of the chamber."

In order to advance prosecution of the present application, Applicant has requested continued examination of an amended set of claims, rendering the Examiner's remarks in this section moot.

Claim Rejections – 35 USC §102

Claims 1-5, 7-11, 13 and 15-20 stand rejected as being anticipated by Kaufman. Applicant respectfully disagrees. To anticipate a claim, the reference must teach every element of the claim and "the identical invention must be shown in as complete detail as is contained in the ... claim." *MPEP 2131* citing *Verdegaal Bros. V. Union Oil Co. of California*, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1987) and *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 9 USPQ2d 1913 (Fed. Cir. 1989).

Applicants' claim 1, as amended, requires the following steps in a method for rapidly controlling the rate of ion generation in an ion source having a filament-cathode and a mirror electrode within walls of a chamber, the filament-cathode and the mirror electrode being opposed along a first direction without intervening structure, the ion source being operable to generate an ion beam from the ionization of an ion precursor gas present in the chamber by electrons emitted from the filament-cathode:

- (1) applying a first potential to a positive end of the filament-cathode, relative to a potential at a negative end of the filament-cathode;
- (2) applying a second potential to the walls of the chamber, relative to the potential at the negative end of the filament-cathode;
- (3) controlling the potential of the mirror electrode between the potential at the negative end of the filament-cathode and the second potential, to control the number of electrons available for ionization; and
- (4) emitting the ion beam from the chamber in a second direction that is generally perpendicular to the first direction.

Kaufman does not disclose any of steps (2), (3) and (4) required by claim 1.

With respect to step (2), Kaufman shows, for example in FIG. 7 and FIG. 8, walls of a chamber (e.g., cylindrical metal shell 82) that do not have any potential applied to them. Kaufman therefore does not disclose step (2) or even define the second potential required by claim 2.

With respect to step (3), Kaufman does not show, at all, a mirror electrode opposed to the filament-cathode along a first direction without intervening structure; therefore Kaufman does not show a step of controlling potential of the mirror electrode between the potential at the negative end of the filament-cathode and a second potential of the walls of the chamber, to control the number of electrons available for ionization. The Examiner's position in paragraph 1 of the present Office Action is that Kaufman's "decelerator grid 106" is a mirror electrode, however the amendment herein to claim 1 requires that such mirror electrode be opposed to the filament-cathode without intervening structure. Kaufman shows a "screen grid 88" and an "acceleration grid 90" in FIG. 8 that form structure intervening between decelerator grid 106 and the filament-cathode. Alternatively, if screen grid 88 is construed as a mirror electrode, its potential cannot be controlled between the potential at the negative end of the filament-cathode and a second potential of the walls of the chamber, because it is electrically connected to the negative end of cathode 46, as shown in FIG. 7 and 8 of Kaufman (e.g., screen grid 88 is electrically connected to an end of cathode 46 that is negatively biased with respect to another end of cathode 46 by energizing source 56). In yet another alternative, if Kaufman's screen grid 88 is construed instead as a "wall" of the chamber, it does not have a second potential applied to it relative to a potential at the negative end of the filament-cathode, and there would be no mirror electrode opposed to the filament-cathode along a first direction without intervening structure.

With respect to step (4), there is no disclosure in Kaufman of emitting an ion beam at all, let alone emitting such beam in a direction that is generally perpendicular to a direction between a filament-cathode and a mirror electrode.

Since steps (2), (3) and (4) of claim 1 as amended are not anticipated by the art of record, Applicant requests the reconsideration and withdrawal of the rejection of claim 1 under 35 U.S.C. §102(b).

Claims 2-5 depend from claim 1 and benefit from like arguments; however these claims include further patentable distinctions over Kaufman.

For example, claim 2 requires that the claim 1 step of controlling comprises reducing an ion beam intensity by driving the potential of the mirror electrode toward the second potential, and claim 3 requires a step of increasing an ion beam intensity by driving the potential of the mirror electrode toward the potential at the negative end of the filament-cathode. Since Kaufman does not disclose a mirror electrode or a second potential as defined in claim 1, Kaufman cannot anticipate driving the potential of the mirror electrode toward the second potential defined in claim 1, or toward the potential at the negative end of the filament-cathode.

Moreover, Kaufman does not disclose “reducing an ion beam intensity” or “increasing an ion beam intensity.” The Examiner points to Kaufman at col. 6 line 47 through col. 7 line 60 as disclosing “to control the electron population and ion generation” (Office Action, page 4); we disagree and point out that even if true, this characterization falls short of an explicit connection to “reducing [or increasing] an ion beam intensity.” Most of the section cited by the Examiner dwells on structural explanations. The most relevant passages within this section appear to be:

“Once more to increase the probability of electrons emitted from cathode 46 having ionizing collisions before reaching anodes 86, magnetic-field lines 96 are generated between permeable pole pieces 98. The means of magnetically energizing the permeable pole pieces 98 again are not shown, but may be either electromagnets or permanent magnets.

“The electron population within the chamber 84 consists of both high-energy electrons emitted by cathode 46 and low-energy randomized, or Maxwellian, electrons, which are both electrons from cathode 46 that have undergone many collisions and electrons resulting from the ionization of neutral gas atoms. The electrons which are extracted to form the electron beam consist, at least in part, of the high-energy electrons. Depending on the size of the apertures in screen grid

88 and the accelerator grid 90, the thicknesses of the grids, the spacing between the grids and the potential difference between the grids, low-energy Maxwellian electrons will also be extracted.” Kaufman, col. 7, lines 22-41, emphasis added.

These passages focus exclusively on controlling an electron population - in accordance with the title of Kaufman, “Broad-beam Electron Source” - not ion generation as supposed by the Examiner, and certainly not on an intensity of an ion beam as required by the claims. These passages thus fall far short of the requirement that “the identical invention must be shown in as complete detail as is contained in the ... claim,” as required under 35 USC §102.

Since claims 2-5 depend from claim 1 and benefit from like arguments, and include further patentable distinctions over the art of record, reconsideration and withdrawal of the rejection of claims 2-5 is requested.

Applicants’ claim 7, as amended, requires the following steps in a method for rapidly controlling the rate of ion generation in an ion source having a filament-cathode and a mirror electrode within walls of a chamber, the filament-cathode and the mirror electrode being opposed along a first direction, and at least one grid electrode having an O-shaped grid portion located between the filament-cathode and the mirror electrode along the first direction, the ion source being operable to generate an ion beam from the ionization of an ion precursor gas present in a chamber by electrons emitted from the filament-cathode:

(1) applying a potential to the filament-cathode, relative to a potential at a negative end of the filament-cathode,

(2) connecting said mirror electrode to the potential at the negative end of the filament-cathode,

(3) controlling the potential of the grid electrode positive or negative relative to the filament-cathode to control the number of electrons available for ionization between the grid electrode and the mirror electrode; and

(4) emitting the ion beam from the chamber in a second direction that is generally perpendicular to the first direction.

Kaufman does not disclose any of steps (2), (3) and (4) required by claim 7.

With respect to steps (2) and (3) above, there is no possible combination of the grids shown in Kaufman that collectively satisfy the requirements of these steps. Kaufman's decelerator grid 106, even if it were construed as a "wall" because it "define[s] an outer boundary of the chamber" as argued by the Examiner, cannot be construed as a mirror electrode because it is not within walls of the chamber. Also, grid 106 is not connected to the potential at the negative end of the filament-cathode, as required of the mirror electrode in step (2). Kaufman's accelerator grid 90 cannot be the mirror electrode, because it, also, is not connected to the potential at the negative end of the filament-cathode as required by step (2). Kaufman's screen grid 88 is connected to the potential at the negative end of the filament-cathode, but if grid 88 is construed as the mirror electrode, then there is no grid electrode located between the filament-cathode and the mirror electrode as required by step (3).

With respect to step (4), there is no disclosure in Kaufman of emitting an ion beam at all, let alone emitting such beam in a direction that is generally perpendicular to a direction between a filament-cathode and a mirror electrode.

Since steps (2), (3) and (4) of claim 7 as amended are not anticipated by the art of record, Applicant requests the reconsideration and withdrawal of the rejection of claim 7 under 35 U.S.C. §102(b).

Claims 8-11 depend from claim 7 and benefit from like arguments; however these claims include further patentable distinctions over Kaufman. For example, claim 8 requires that the step of controlling comprises reducing an ion beam intensity by driving the potential of the grid electrode negative relative to the filament-cathode. Since Kaufman does not disclose a grid electrode as defined in claim 7, Kaufman cannot anticipate driving the potential of a grid electrode negative relative to the filament-cathode. Moreover, Kaufman does not disclose "reducing an ion beam intensity," as discussed in connection with claims 2 and 3 above. Claim 9 requires that the step of controlling comprises increasing an ion beam intensity by driving the potential of the grid electrode to or near the potential of the filament-cathode. Again, since Kaufman

does not disclose a grid electrode, Kaufman cannot anticipate driving the potential of a grid electrode negative relative to the filament-cathode, and Kaufman does not disclose “increasing an ion beam intensity.” Since claims 8-11 depend from claim 1 and benefit from like arguments, and include further patentable distinctions over the art of record, reconsideration and withdrawal of the rejection of claims 8-11 is requested.

Claim 13 is for an ion source apparatus for rapidly modulating an intensity of an ion beam, and requires:

(1) an ion chamber having mutually opposed walls that are fixed at a wall potential, one of the walls forming an aperture for emitting the ion beam in a first direction, the chamber configured to receive an ion precursor gas;

(2) a filament-cathode that is located on one side of said ion chamber, fixed at a filament-cathode potential and operable to emit electrons for ionization of the ion precursor gas for generation of the ion beam; and

(3) a mirror electrode having a potential associated therewith and located on the other side of said ion chamber in a second direction relative to the filament-cathode, the second direction being approximately perpendicular to the first direction, said mirror electrode being connected to a circuit to vary its potential relative to said wall potential and the filament-cathode potential so as to vary the number of the electrons available in the ion chamber for ionization.

Kaufman does not disclose either of elements (1) or (3) required by claim 13.

With respect to element (1), Kaufman’s cylindrical metal shell 82 is not fixed at a wall potential; no electrical connections to shell 82 are shown in FIG. 7 or 8 of Kaufman. Furthermore, shell 82 does not have a wall forming an aperture for emitting an ion beam in a first direction. Kaufman’s apparatus is intended to emit an electron beam: “Thus, the electrons proceed along an electron-beam path indicated by arrow 92.” Kaufman, col. 6, line 67 - col. 7, line 1. There is no mention at all of an ion beam in Kaufman, let alone disclosure of an aperture for emitting, or direction of, an ion beam.

With respect to element (3), Kaufman does not disclose a mirror electrode located on the other side of an ion chamber from the filament-cathode in a second direction that is approximately perpendicular to the first direction or that the mirror electrode is connected to a circuit to vary its potential relative to said wall potential and the filament-cathode potential so as to vary the number of the electrons available in the ion chamber for ionization. Since Kaufman does not disclose the first direction as specified in element (1), the mirror electrode and filament-cathode are not disclosed as being located on the other side of the ion chamber from each other. Furthermore, no mirror electrode is disclosed as connected to a circuit to vary its potential relative to the wall potential and the filament-cathode potential. Thus Kaufman's grids do not meet the element 3 definition of a mirror electrode wherein its potential can vary relative to both the wall potential and the filament-cathode potential.

Since elements (1) and (3) of claim 13 as amended are not anticipated by the art of record, Applicant requests the reconsideration and withdrawal of the rejection of claim 13 under 35 U.S.C. §102(b). Claims 15 and 16 depend from claim 13 and benefit from like arguments; Applicant likewise requests reconsideration of the rejection of claims 15 and 16.

Claim 17 is for an ion source apparatus for rapidly modulating an intensity of an ion beam, and requires:

(1) an ion chamber having mutually opposed walls that are fixed at a wall potential, one of the walls forming an aperture for emitting the ion beam in a first direction, the chamber configured to receive an ion precursor gas,

(2) a filament-cathode that is located on one side of said ion chamber, fixed at a filament potential and operable to emit electrons for ionization of the ion precursor gas for generation of the ion beam,

(3) a mirror electrode located on the other side of said ion chamber in a second direction relative to the filament-cathode, the second direction being approximately perpendicular to the first direction, and

(4) at least one grid electrode extending inside said ion chamber and positioned between said filament-cathode and said mirror electrode along the second direction, said at least one grid electrode being connected to a circuit operable to vary a potential of the grid electrode positive or negative relative to said filament-cathode so as to vary the number of electrons available in the ion chamber for ionization.

Kaufman does not disclose any of elements (1), (3) and (4) required by claim 17.

With respect to element (1), as noted above in connection with claim 13, Kaufman's cylindrical metal shell 82 is not fixed at a wall potential, no electrical connections being shown; there is no mention of an ion beam in Kaufman, let alone disclosure of an aperture for emitting, or direction of, an ion beam.

With respect to element (3), as noted above in connection with claim 13, Kaufman does not disclose a mirror electrode located on the other side of the ion chamber from the filament-cathode in a second direction that is approximately perpendicular to the first direction; since Kaufman does not disclose the first direction as specified in element (1), a mirror electrode and a filament-cathode are not disclosed as being located on the other side of the ion chamber from each other.

With respect to element (4), since no mirror electrode is disclosed (as discussed with respect to element (3)) no grid electrode can be positioned between the filament-cathode and the mirror electrode. Also, Kaufman does not disclose a circuit operable to vary a potential of such a grid electrode positive or negative relative to the filament-cathode. Similar arguments apply here as in connection with steps (2) and (3) of claim 7: Kaufman's screen grid 88 cannot be the grid electrode because it is connected to the negative end of the filament cathode and thus its potential cannot vary as required; acceleration grid 90 cannot be the grid electrode because is always positively biased with respect to the filament-cathode; deceleration grid 106 cannot be the grid electrode because then there is no mirror electrode.

Since elements (1), (3) and (4) of claim 17 as amended are not anticipated by the art of record, Applicant requests the reconsideration and withdrawal of the rejection of claim 17 under 35 U.S.C. §102(b). Claims 18 and 19 depend from claim 17 and benefit

from like arguments; Applicant likewise requests reconsideration of the rejection of claims 18 and 19.

Claim 20 also depends from claim 17 and benefits from like arguments; claim 20 also requires that the grid electrode is positioned in proximity to said filament-cathode so as to vary the number of electrons available for ionization between said at least one grid electrode and said mirror electrode. Since, as discussed above, Kaufman does not disclose the grid electrode defined in claim 17, Kaufman also does not disclose such an electrode being positioned in proximity to the filament-cathode. Since claim 20 depends from claim 17 and includes an additional limitation that patentably distinguishes over the art of record, Applicant requests reconsideration and withdrawal of the rejection of claim 20.

Allowable Subject Matter

Applicant acknowledges the Examiner's recognition of claims 6, 12 and 14 as allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

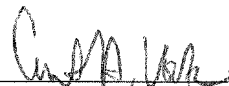
In view of the above Amendments and Remarks, Applicant has addressed all issues raised in the Office Action dated 25 October 2006, and respectfully solicits a Notice of Allowance. Should any issues remain, the Examiner is encouraged to telephone the undersigned.

The \$350 fee for six new claims including two independent claims, and the \$395 fee for a Request for Continued Examination, both based on small entity status, are enclosed herewith. Applicant believes no other fees are currently due, however, if any fee is deemed necessary in connection with this Amendment and Response, please charge Deposit Account No. 12-0600.

Respectfully submitted,

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